

Concise Communication

Use of diagnostic stewardship practices to improve urine culturing among SHEA Research Network hospitals

Kaede V. Sullivan MD, MSc¹, Daniel J. Morgan MD, MS^{2,3} and Surbhi Leekha MD, MPH²

¹Department of Pathology and Laboratory Medicine, Lewis Katz School of Medicine at Temple University, Philadelphia, Pennsylvania, ²Department of Epidemiology and Public Health, University of Maryland School of Medicine, Baltimore, Maryland and ³Veterans Affairs Maryland Healthcare System, Baltimore, Maryland

Abstract

This survey investigated interventions used by acute-care hospitals to reduce the detection of asymptomatic bacteriuria. Half of the respondents reported using reflex urine cultures but with varied urinalysis criteria and perceived outcomes. Other diagnostic stewardship interventions for urine culture ordering and specimen quality were less common.

(Received 31 August 2018; accepted 24 November 2018; electronically published 7 December 2018)

Asymptomatic bacteriuria often leads to inappropriate antimicrobial use.¹ If culturing is associated with nonspecific symptoms such as fever, a catheter-associated urinary tract infection (CAUTI) may be reported.² Diagnostic stewardship strategies that reduce laboratory detection of asymptomatic bacteriuria may help to mitigate these negative outcomes. We conducted a survey to investigate the interventions used by acute-care hospitals to reduce unnecessary laboratory detection of asymptomatic bacteriuria.

Methods

Survey development and administration

We conducted a survey on adult urine culturing practices among acute-care hospitals in the Society for Healthcare Epidemiology Research Network (SRN). A 16-item survey was created using Magnet Mail Surveys software. The survey recorded demographic characteristics of the respondent institutions; institutional practices pertaining to urine culture ordering, urine collection, and transport; and in institutions that offer reflex urine cultures, the urine sources accepted for reflex testing, restriction of reflex urine cultures to specific patient populations, and strategic use of the electronic medical record (EMR) to guide orders toward reflex urine cultures. Reflex urine culture was described as follows: “Reflex urine culturing involves screening urine samples with a urinalysis (‘UA’) first. Urine is processed for culture only if pre-defined criteria are met.” Respondents were advised to consult with their laboratory for questions related to urine culture processing. The survey was e-mailed to SRN members on 3 occasions, and responses were accepted between March 22 and April

30, 2018. Survey results were analyzed using JMP Pro 13 software (SAS Institute, Cary, NC).

Results

Survey demographics

The survey was e-mailed to the 132 members of the SRN; e-mails to 10 members bounced back or the member opted out. The response rate was 43% (52 of 122). Among respondents, 39 of 52 (75%) were based in the United States or Canada and 27 of 52 (52%) described themselves as an academic medical center. An additional 16 of 52 respondents (31%) affirmed an affiliation with a medical school.

Urine culture ordering

Questionnaire responses are summarized in the Supplementary Material online. Of respondents, 23 of 52 (44%) reported that their hospital had published indications for ordering a urine culture. Of these, 4 of 23 (17%) reported that an indication had to be entered into their EMR when ordering a urine culture.

Reflex urine culturing

Among respondents, 26 of 51 (51%; 66% in the United States and Canada and 8% of international respondents) reported that their laboratory offers reflex urine cultures. Of these 26 respondents, 14 (54%) reported that their EMR was configured to guide the ordering clinician preferentially toward reflex urine cultures. Strategies included placing the reflex urine culture option at the top of a list of options with routine urine culture located further down the list and/or having the reflex urine culture option “pre-checked.”

Table 1 summarizes the respondents using reflex urine culture. Among them, 25 of 26 respondents (96%) reported being able to order urine culture without a urinalysis, but 5 of 26 (19%) indicated restriction of “urine culture only” orders to certain

Author for correspondence: Kaede V. Sullivan, Temple University Hospital, 3401 Broad St, Room A2 F329, Philadelphia, PA 19140. E-mail: kaede.ota@tuhs.temple.edu

Cite this article: Sullivan KV, et al. (2019). Use of diagnostic stewardship practices to improve urine culturing among SHEA Research Network hospitals. *Infection Control & Hospital Epidemiology* 2019, 40, 228–231. doi: 10.1017/ice.2018.325

Table 1. Practices of Institutions Using Reflex Urine Cultures

Institution	Urine Tests Offered by Laboratory			Specimens and Patients Eligible for Reflex Urine Cultures		UA Criteria Elements for Reflexing to Urine Culture ^c				
	RUC	UA Only	Culture Only	Specimens	Patients	LE	Nitrite	Other	WBC/ μ L	Bacteria
1	Y	Y	Y	All	All	M-L	POS	...	>10	...
2	Y	Y	Y	All	All	POS	POS	...	>10	...
3	Y	Y	Y	All	All	POS	POS	...	>10	“Many”
4	Y	Y	N	IUC only	All	POS	POS	...	>10	...
5	Y	Y	Y	All	All	POS	POS	“Sediment”	>3	...
6	Y	Y	Y	IUC only	All	...	...	...	>10	...
7	Y	Y	Y ^b	All	All	...	...	...	>10	...
8	Y	Y	Y	All	ED, OP	...	...	...	>10	...
9	Y	Y	Y ^b	All	All	...	...	...	>10	...
10	Y	Y	Y ⁷	All	ED, IP	POS	POS	...	>5	...
11	Y	Y	Y	All	All	NS	NS	NS	NS	NS
12	Y	Y	Y	All	All	...	...	...	>5	...
13	Y	Y	Y	All	All	POS	POS	...	>10	“Moderate to many”
14	Y	Y	Y ^b	All	OP only	...	...	...	>5	...
15	Y	Y	Y	All	All	POS	POS	See ^d	...	...
16	Y	Y	Y	All	All	POS	POS	See ^e	>5	...
17	Y	Y	Y	All	All	...	...	...	>5	...
18	Y	Y	Y	All	ED only	POS	POS	Yeast present	>3	...
19	Y	N ^a	N ^a	All	All	...	...	...	>10	...
20	Y	Y	Y	All	All	POS	POS	...	>10	...
21	Y	Y	Y	All	All	POS	POS	Protein >30 mg/dL, “blood”	...	...
22	Y	DNK	Y ^b	All	All	...	POS	...	>20	...
23	Y	Y	Y	All	All	POS	POS	Yeast	>4	“Moderate”
24	Y	Y	Y	All	All	POS	POS	...	>5	“3+ or greater”
25	Y	Y	Y	All	All	...	...	...	\geq10	...
26	Y	Y	Y	CC only	All	...	POS	...	>10	...

Note. RUC, reflex urine culture; UA, urinalysis; LE, leukocyte esterase; WBC, white blood cell; DNK, do not know; IUC, indwelling urinary catheter; CC, clean catch urine; ED, emergency department; OP, outpatients; IP, inpatients; M, moderate; L, large; NS, not stated.

^aInstitution #19 reported that all positive UA proceed to culture and that all cultures require UA.

^bThese institutions offered the option of ordering urine culture without UA, but the option was limited to certain populations: respondent #7 (urology patients for preoperative screening); #9 (pregnancy, neonate, neutropenia, renal transplantation); #10 (patients under age 25 months, pregnancy, patients undergoing genitourinary procedures and neutropenia (ANC <100)); #14 (renal transplant, certain urologic patients, pregnancy); #22 (pregnancy, urologic procedures)

^cAssume an “AND/OR” after each element. For example, institution #1’s criteria were >10 WBC and/or moderate or large leukocyte esterase and/or positive nitrite.

^dAdditional criteria for institution #15: in neutropenic patients, “positive leukocyte esterase OR positive nitrite OR blood OR protein.”

^eAdditional criteria for institution #16: “hgb > small, LE +, nitrite + or protein > 100 if these positive then micro done. If WBC >11 or WBC 6–10 with >30 protein culture would be done.”

circumstances (eg, pregnancy, neutropenia, neonates, renal transplantation, and screening prior to urologic procedures). Only 1 respondent reported that all urine cultures had to be coupled with a UA. Also, 24 of 26 respondents (92%) indicated that UA could be ordered alone, and 1 respondent stated that all positive UAs proceed to urine culture at that institution. Most respondents (21 of 26, 81%) stated that their laboratory accepts urine from all sources (eg, clean-catch, indwelling catheter, other) for reflex urine culturing but 2 of 26 (8%) reported restriction to urine from indwelling urinary catheters. Most respondents (22 of 26, 85%) indicated that reflex urine cultures were available to all patients. The remainder reported restriction to inpatients, outpatients, and/or the emergency department.

In reflex urine cultures, the criteria used to designate a urinalysis as “positive” varied. Almost all respondents (25 of 26, 96%) reported the inclusion of white blood cells per high-power field (with a variety of WBC cutoffs), and most (19 of 26, 76%) reported inclusion of leukocyte esterase and nitrite status.

Following implementation of reflex urine culturing, 7 respondents (27%) perceived a decrease in their CAUTI rates; 7 (27%) perceived no change; 3 (11%) perceived an increase; and 9 (35%) were uncertain. Of the 10 institutions reporting no change or an increase, 3 restricted reflex urine culturing to emergency department patients and outpatients.

Urine collection and laboratory processing

Most respondents (50 of 52, 96%) reported that their nurses receive training on appropriate urine collection technique, and 39% reported that their laboratory proceeds with urine culture even when there is a delay in transporting the urine to the laboratory. Only 35% of respondents reported that their institution encourages submission of urine in transport devices containing boric acid preservative.

Urine culture reporting

Moreover, 90% of respondents reported that their laboratory reports a “mixed” urine culture with no further organism workup when 3 or more uropathogens are recovered. In positive urine cultures, 23 of 52 respondents (44%) reported using cascade antibiotic susceptibility reporting; 23 of 52 (44%) reported selectively suppressing reporting of certain antibiotics; and 15 of 52 (29%) indicated reporting of all antibiotics tested.

Discussion

Diagnostic stewardship of urine cultures was common among SRN hospitals. Half of respondents reported that they had implemented reflex urine cultures at their institution. However, order restriction based on clinical symptoms and interventions aimed at improving the quality of urine specimens processed for urine culture was uncommon.

Inappropriate urine culturing of asymptomatic patients is common.¹ Only 44% of respondents reported that their institution had written indications for urine culturing, and only 17% required documentation of symptoms to order urine cultures. EMR-based decision support may be an effective way to ensure that clinical symptoms are considered when placing urine culture orders.³

Two-thirds of North American respondents indicated that their laboratory offers reflex urine cultures, suggesting that this

practice has gained acceptance. However, the perceived impact of reflex urine culturing was mixed and could be explained by differences in how institutions defined and implemented reflex urine culturing. When introduced as an alternative to “routine” urine culturing, reflex urine culturing has been found to decrease urine culturing, reported CAUTI rates, and antibiotic use.^{4,5} However, when all urine samples with positive urinalysis automatically reflex to culture regardless of symptoms, unnecessary urine culturing will occur. Dietz *et al*⁶ reported a reduction in urine culture orders and antibiotic use after *de-implementing* reflex urine culturing; this finding reinforces the importance of ordering reflex urine cultures in symptomatic patients only.

Respondents reported a wide range of urinalysis criteria, and almost all included pyuria. Although the presence of pyuria does not predict UTI, the absence of pyuria can exclude UTI with a high negative predictive value, making it a useful strategy to limit unnecessary urine cultures.^{7,8} Prolonged transport of urine cultures can decrease their accuracy due to bacterial overgrowth. The American Society for Microbiology recommends that laboratories reject urine culture orders when urine is received >2 hours after collection without preservative to avoid reporting false-positive cultures.⁹ However, 40% of respondents indicated that their laboratories proceed with urine cultures even after prolonged specimen transport, and only 35% reported the use of boric acid preservative.

This study has limitations. We had a limited sample with only 52 respondent hospitals overall, and >80% had an academic affiliation, which may limit the generalizability of our findings.

In summary, we identified a variety of opportunities for reduction of unnecessary urine culturing. Requiring (and educating on) symptom-based indications for ordering urine cultures, canceling urine culture orders after prolonged transport without preservative, and reflex urine culturing are all interventions that that can be implemented to reduce unnecessary detection of asymptomatic bacteriuria.

Supplementary material. To view supplementary material for this article, please visit <https://doi.org/10.1017/ice.2018.325>

Acknowledgments. We thank Valerie Deloney from SHEA for her contribution to the survey, its distribution, and summary of results. All other authors have no conflicts to declare, financial or otherwise.

References

1. Nicolle LE, Bradley S, Colgan R, Rice JC, Schaeffer A, Hooton TM. Infectious Diseases Society of America guidelines for the diagnosis and treatment of asymptomatic bacteriuria in adults. *Clin Infect Dis* 2005;40:643–654.
2. Urinary tract infection (catheter-associated urinary tract infection [CAUTI] and non-catheter-associated urinary tract infection [UTI]) and other urinary system infection [USI] events. Centers for Disease Control and Prevention website. <https://www.cdc.gov/nhsn/PDFs/pscManual/7pscCAUTIcurrent.pdf>. Accessed August 22, 2018.
3. Keller SC, Feldman L, Smith J, Pahwa A, Costrove SE, Chida N. The use of clinical decision support in reducing diagnosis of and treatment of asymptomatic bacteriuria. *J Hosp Med* 2018;13:392–395.
4. Epstein L. Evaluation of a novel intervention to reduce unnecessary urine cultures in intensive care units at a tertiary care hospital in Maryland, 2011–2014. *Infect Control Hosp Epidemiol* 2016;37:606–609.
5. Sarg M, Waldrop GE, Beier MA, *et al*. Impact of changes in urine culture ordering practice on antimicrobial utilization in intensive care units at an academic medical center. *Infect Control Hosp Epidemiol* 2016;37:448–454.

6. Dietz J, Lo TS, Hammer K, Zegarra M. Impact of eliminating reflex urine cultures on performed urine cultures and antibiotic use. *Am J Infect Control* 2016;44:1750–1751.
7. Tambyah PA, Maki DG. The relationship between pyuria and infection in patients with indwelling urinary catheters: a prospective study of 761 patients. *Arch Intern Med* 2000;160:673–677.
8. Stovall RT, Haenal JB, Jenkins TC, *et al.* A negative urinalysis rules out catheter-associated urinary tract infection in trauma patients in the intensive care unit. *J Am Coll Surg* 2013;217:162–166.
9. Chan WW. Section 3.12: Urine cultures. In: Amy Leber, ed. *Clinical Microbiology Procedures Handbook*, 4th ed. Washington, DC: ASM Press, 2016.